

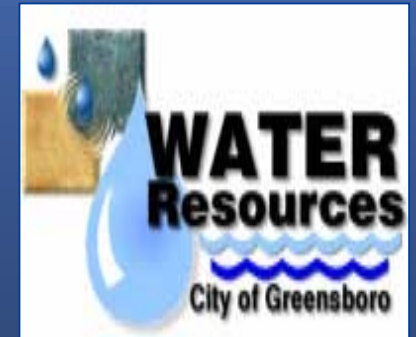
# Public Information Meeting

December 11, 2000

## Stream Identification and Mapping Project



City of Greensboro  
Water Resources Department  
Stormwater Management Division



# Agenda

- 6:30 - 6:35 Welcome (Jeremy Thomas)
- 6:35 - 6:40 Project Introduction/History (Jeremy Thomas)
- 6:40 - 7:00 Project Details/Status (Richard Darling)
- 7:00 - 7:30 Questions & Comments

Thanks for attending!

# Project History

- Existing State Approved Map
- Limitations
- No Reliable Map Source
- Accurate Map vs. Site -Specific Determinations

# Project Purpose

- Proactive - Meeting Water-Supply Watershed Stream Buffer Requirements
- Accurate Map - “scientifically defensible methodology”
- Comprehensive Map - Minimize need for site specific determinations

# Existing Stream Buffer Requirements

- Existing Water-Supply Watershed Protection
- Randleman Lake Buffer Protection
- Future Cape Fear Basin Riparian Buffer Rule

# Project Team

- City of Greensboro  
Stormwater Management Division
- Law Engineering & Environmental Svcs.  
Primary Consultant
- Water Resource Research Institute  
Dr. James Gregory, NCSU Forestry
- NC Division of Water Quality



- Stakeholders - Regulators, Municipal Interests, Development Community, Environmental Interests

# Project Objective

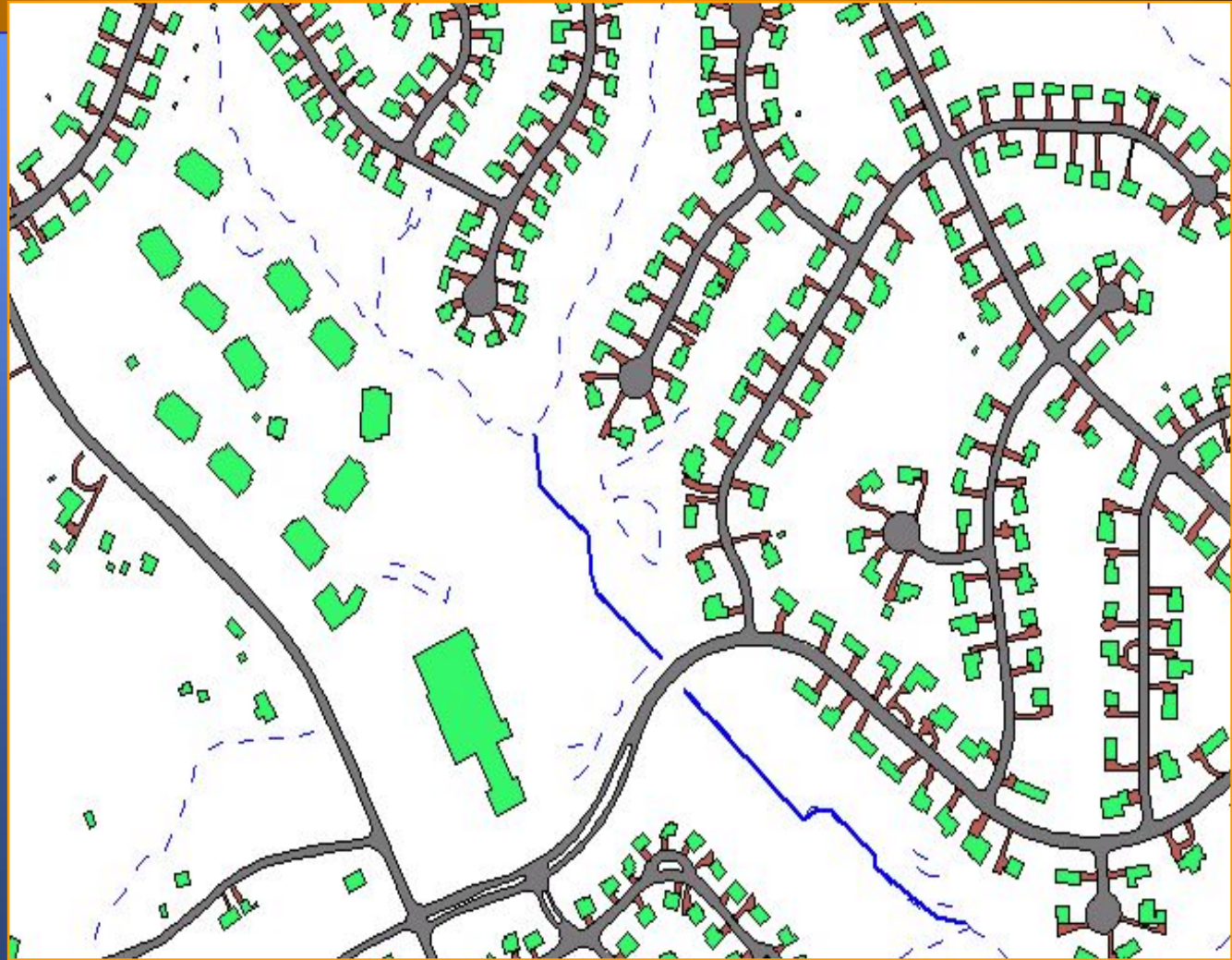
- Accurate Field Identification of *Perennial* and *Intermittent* Stream Breakpoints





# Project Objective

GIS  
Layer





# Project Milestones

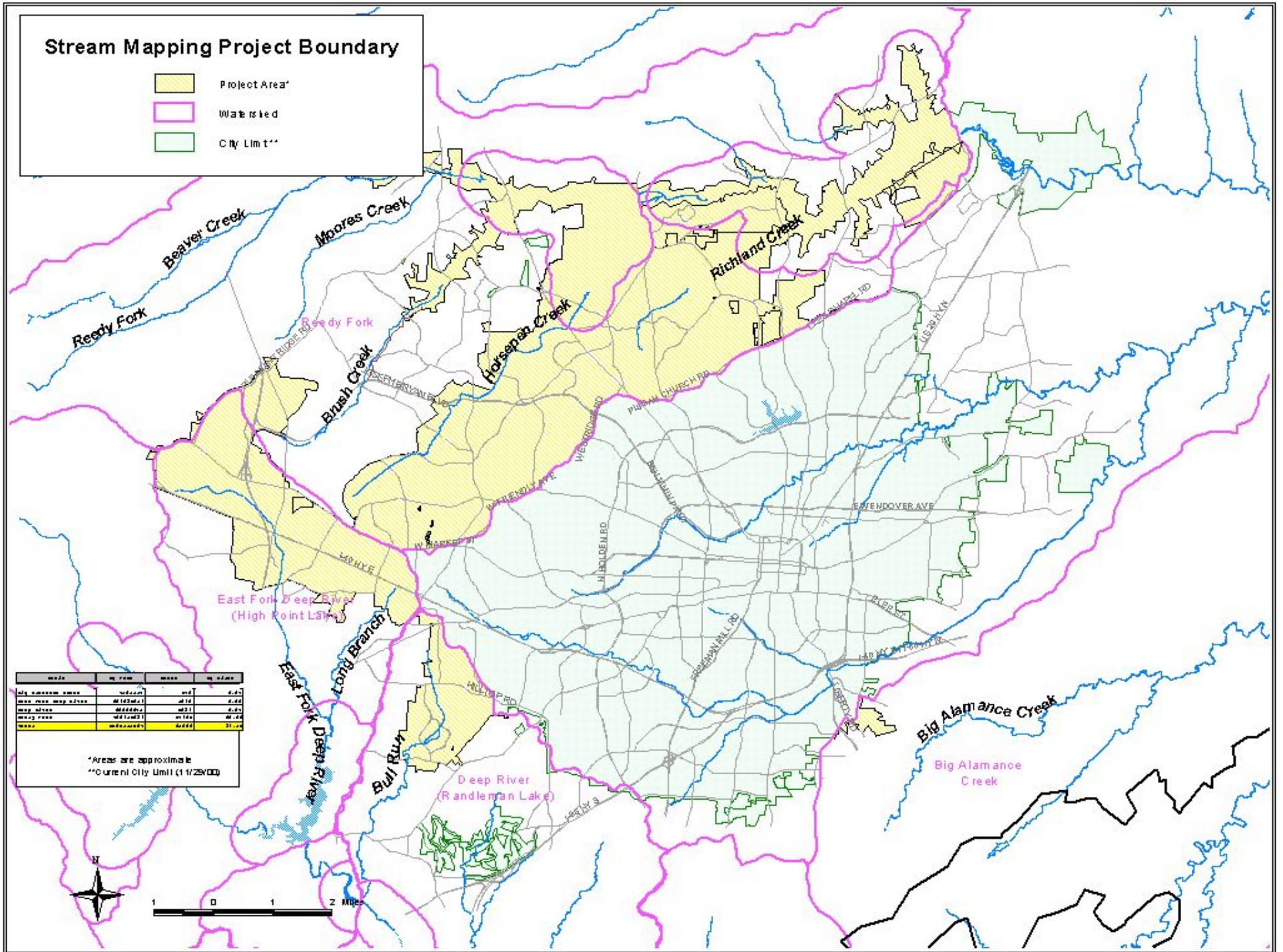
- Project Commenced  
June 2000 (Pilot Workbasin Field Application)
- Intermittent Methodology Approval  
August 2000
- Perennial Methodology Approval  
November 2000
- Full Field Mobilization  
December 2000
- Final Maps Anticipated  
June 2001

# Stream Mapping Project Boundary

- Project Area\*
- Watershed
- City Limit\*\*

map	map	map	map
big alamance creek	deep river	east fork deep river	long branch
big alamance creek	deep river	east fork deep river	long branch
big alamance creek	deep river	east fork deep river	long branch
big alamance creek	deep river	east fork deep river	long branch
big alamance creek	deep river	east fork deep river	long branch
big alamance creek	deep river	east fork deep river	long branch
big alamance creek	deep river	east fork deep river	long branch
big alamance creek	deep river	east fork deep river	long branch
big alamance creek	deep river	east fork deep river	long branch

\*Areas are approximate  
 \*\*Current City Limit (1/1/2000)





# Field Identification - What is a Stream?



# Project Methodology

- Comprehensive Workplan
  - Detail Field Procedures
  - GIS Database Design
  - QA/QC Plan
- Test Area - Evaluate Appropriateness of Field Methodology
- SubBasin Approach
- Integrate project with City Stormwater Conveyance System Inventory Project



Windows Explorer window showing a photo of a pipe inlet/outlet structure.

☒ Scale Image

1. Pipe Inlet / Outlet - PI	
gps_id	2586
gps_y	846745.138
gps_x	1746760.538
gps_rm_id	825.450
gps_struct	PIPEID
inv_class	GPS
Occupation	TOP/HDWALL
gps_cond	OK
gps_date	
Yrig	
Photo	yes
Photo_id	01-080
Feature_ty	pipe outlet
Elev	825.45
inv_elev	
Depth	
Surround	stone/gravel
System	city
Source	
Source_dtl	
Nodes_out	
Final_dsc	
Sub_bsn	
Inspection	
Comments	DD=5.45'
Initials	
Date_visit	
gps_hardware	

Clear Clear All

2:49 PM



# Methodology

LAWGIBB proposes to complete the required scope by applying a project-tested methodology, including the following tasks:

- Database Design/Methodology
- Stream Identification
- Stream Field Classification
- Data compilation/GPS/GIS input
- Geographic Information System
- Coordination with the City of Greensboro
- Meetings
- Regulatory Coordination
- Public Coordination
- Presentation(s)
- Report(s) / Maps



# Methodology

## Stream Field Classification

A two-phased approach identifying the approximate location of the beginning of intermittent channels and the beginning of perennial channels (equivalent to the termination of intermittent channel status) will be employed.

**Intermittent** streams are defined by a rating of at least 19 points using Version 2.0 of the DWQ Stream Classification Method dated January 19, 1999.

Current DWQ policy defines **perennial** streams as streams which display one of the following criteria:

- a calculated positive flow during certain drought events (7Q10 or 30Q2); or
- aquatic vertebrates and large invertebrates (i.e., fish, shellfish, and crayfish).

Type Stage	Form Name	Case File	County	City/Town	Endorse:
2000 Project Number	Universal Transit/Class	Latitude			Signature
Date	1000 QUAD	Longitude			License/Overseer

**\*PLEASE NOTE:** If evaluator and landowner agree that the feature is a man-made ditch, then one of the first two questions may also fit the best professional judgment of the evaluator. The feature is a man-made ditch and not a modified natural stream—the rating question(s) will be used.

**Primary Field Indicators:** (Check the Number Per Line)

	Absent	Weak	Medium	Strong
1. Geomorphology				
1a) Is There a Riffle-Pool Sequence?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2a) Is The 25%a Terrace Incised/Overlapped From Successive Terraces?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3a) Are Natural Levees Present?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4a) Is The Channel Graded?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5a) Is There An Avulsion (Or Bedrock Fluvial) Present?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6a) Is The Channel Graded?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7a) Are Exposed Alluvial Deposits Present?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8a) Is There A Bankfull Bench Present?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9a) A Combination Of A Bed Bench Present? (NOTE: If Not A Bed Bench Due To Ditching And WEEDING, Answer No/Unsure)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10a) Is A Jet Order Or Greater Channel/An Indicated On Type Map Available In Field Present?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**PRIMARY GEOMORPHOLOGY INDICATOR POINTS:** #VALUE!

	Absent	Weak	Medium	Strong
11. Hydrology				
11a) Is There A Streambed? (Note: Can Be Present)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**PRIMARY HYDROLOGY INDICATOR POINTS:** #VALUE!

	Absent	Weak	Medium	Strong
12. Biology				
12a) Are Plants From Present In Streambed?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2a) Are Exposed Plants Present In Channelbed?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3a) Is Periphyton Present?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4a) Are Animals Present?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**PRIMARY BIOLOGY INDICATOR POINTS:** #VALUE!

**Secondary Field Indicators:** (Check the Number Per Line)

	Absent	Weak	Medium	Strong
1. Geomorphology				
1a) Is There A Broad Cut Present In Channel?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2a) Is There A Broad Control Point In Channel?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3a) Does Topography Indicate A Natural Depression? (If Not)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**SECONDARY GEOMORPHOLOGY INDICATOR POINTS:** #VALUE!

	Absent	Weak	Medium	Strong
11. Hydrology				
11a) Is Your Tool's Or Last's Location Present In Streambed?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2a) Is Sediment On Shore (Or Ditch) Present?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3a) Are Weeds Litter Present?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4a) Is Water In Channelbed? (If Not, See Note)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5a) Is There Water In Channel? (NOTE: If Not, Answer Is No, Answer Is No, Answer Is No)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6a) Is There Water In Channel During Low Flow/High Water On In Stream Segment?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7a) Are Hyacinths Present In Ditch/Channel? (Or Is Bankfull?)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**SECONDARY HYDROLOGY INDICATOR POINTS:** #VALUE!

	Absent	Weak	Medium	Strong
12. Biology				
12a) Are Fish Present?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2a) Are Amphibians Present?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3a) Are Aquatic Insects Present?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4a) Are Crustaceans Present?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5a) Are Mollusks Present?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6a) Are Invertebrates Present?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7a) Is Plantation/Algae Present?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8a) Are Wetland Plants In Channelbed?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**SECONDARY BIOLOGY INDICATOR POINTS:** #VALUE!

**TOTAL POINTS (Primary + Secondary):** #VALUE! (If Greater Than Or Equal To 25 Points The Stream Is A Good Investment)

The four-tiered weighted scale is designed to encompass the range in variability of each character likely to be observed in the field.

Observations of primary and secondary geomorphologic, hydrologic, and biological indicators will be recorded on the DWQ Stream Classification Form.





A topographic map of the Chelsea Commons area, showing green contour lines, blue water bodies, and grey building footprints. A red line runs diagonally across the map. Three callout boxes are present: a brown box in the top left labeled 'HP-1', a red box in the top right labeled 'Chelsea Commons I-P Point', and an orange box in the bottom right labeled 'Chelsea Commons E-I Point'. A blue line with arrows indicates a path from the HP-1 area towards the Chelsea Commons E-I Point. A red arrow points from the HP-1 area to the Chelsea Commons I-P Point. An orange arrow points from the Chelsea Commons E-I Point to the Chelsea Commons I-P Point.

HP-1

Chelsea Commons  
I-P Point

Cotswald Terrace 1  
E-I Point

Chelsea Commons  
E-I Point





## Chelsea Commons

Ephemeral-Intermittent (E-I)  
Point, facing upstream.

Orange flag indicates location  
determined with GPS.

Documented Stream  
Classification Form applies  
downstream (at least 100 feet)  
only.

Upstream rated less than 19



## Chelsea Commons

Ephemeral-Intermittent (E-I)  
Point, facing downstream.

Orange flag indicates location  
determined with GPS.

Classified as at least  
Intermittent based on rating of  
24

## NCDWQ Stream Classification Form

Project Name:	<i>Stream Identification and Mapping for Water Quality Assessment</i>	River Basin:	<b>Cape Fear</b>	County:	<b>Guilford</b>	Evaluator:	
DWQ Project Number:		Nearest Named Stream:		Latitude:		Signature:	
Date:		USGS QUAD:		Longitude:		Location/Directions:	

**\*PLEASE NOTE:** If evaluator and landowner agree that the feature is a man-made ditch, then use of this form is not necessary. Also, if in the best professional judgement of the evaluator, the feature is a man-made ditch and not a modified natural stream—this rating system should not be used\*

### Primary Field Indicators: (Circle One Number Per Line)

I. Geomorphology	Absent	Weak	Moderate	Strong	Notes
1) Is There A Riffle-Pool Sequence?	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	
2) Is The USDA Texture In Streambed Different From Surrounding Terrain?	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	
3) Are Natural Levees Present?	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	
4) Is The Channel Sinuous?	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	
5) Is There An Active (Or Relic) Floodplain Present?	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	
6) Is The Channel Braided?	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	
7) Are Recent Alluvial Deposits Present?	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	
8) Is There A Bankfull Bench Present?	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	
9) Is A Continuous Bed & Bank Present? (*NOTE: If Bed & Bank Caused By Ditching And WITHOUT Sinuosity Then score=0*)	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	
10) Is A 2nd Order Or Greater Channel (As Indicated On Topo Map And/Or In Field) Present?	<input type="radio"/> Yes=3	<input type="radio"/> No=0			

### PRIMARY GEOMORPHOLOGY INDICATOR POINTS:

**#VALUE!**

II. Hydrology	Absent	Weak	Moderate	Strong	
1) Is There A Groundwater Flow/Discharge Present?	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	

### PRIMARY HYDROLOGY INDICATOR POINTS:

**#VALUE!**

III. Biology	Absent	Weak	Moderate	Strong	
1) Are Fibrous Roots Present In Streambed?	<input type="radio"/> 3	<input type="radio"/> 2	<input type="radio"/> 1	<input type="radio"/> 0	
2) Are Rooted Plants Present In Streambed?	<input type="radio"/> 3	<input type="radio"/> 2	<input type="radio"/> 1	<input type="radio"/> 0	
3) Is Periphyton Present?	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	
4) Are Bivalves Present?	<input type="radio"/> 0	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	

### PRIMARY BIOLOGY INDICATOR POINTS:

**#VALUE!**



**Secondary Field Indicators:** (Circle One Number Per Line)

I. Geomorphology		Absent	Weak	Moderate	Strong	
1)	Is There A Head Cut Present In Channel?	<input type="radio"/> 0	<input type="radio"/> 0.5	<input type="radio"/> 1	<input type="radio"/> 1.5	
2)	Is There A Grade Control Point In Channel?	<input type="radio"/> 0	<input type="radio"/> 0.5	<input type="radio"/> 1	<input type="radio"/> 1.5	
3)	Does Topography Indicate A Natural Drainage Way?	<input type="radio"/> 0	<input type="radio"/> 0.5	<input type="radio"/> 1	<input type="radio"/> 1.5	

SECONDARY GEOMORPHOLOGY INDICATOR POINTS:

#VALUE!

II. Hydrology		Absent	Weak	Moderate	Strong	
1)	Is This Year's (Or Last's) Leaf litter Present In Streambed?	<input type="radio"/> 1.5	<input type="radio"/> 1	<input type="radio"/> 0.5	<input type="radio"/> 0	
2)	Is Sediment On Plants (Or Debris) Present?	<input type="radio"/> 0	<input type="radio"/> 0.5	<input type="radio"/> 1	<input type="radio"/> 1.5	
3)	Are Wrack Lines Present?	<input type="radio"/> 0	<input type="radio"/> 0.5	<input type="radio"/> 1	<input type="radio"/> 1.5	
4)	Is Water In Channel <b>And</b> >48 Hrs. Since Last <b>Known</b> Rain? (*NOTE: If Ditch Indicated In #9 Above Skip This Step And #5 Below *)	<input type="radio"/> 0	<input type="radio"/> 0.5	<input type="radio"/> 1	<input type="radio"/> 1.5	
5)	Is There Water In Channel During Dry Conditions Or In Growing Season?	<input type="radio"/> 0	<input type="radio"/> 0.5	<input type="radio"/> 1	<input type="radio"/> 1.5	
6)	Are Hydric Soils Present In Sides Of Channel (Or In Headcut)?	<input type="radio"/> Yes=1.5	<input type="radio"/> No=0			

SECONDARY HYDROLOGY INDICATOR POINTS:

#VALUE!

III. Biology			Absent	Weak	Moderate	Strong	
1)	Are Fish Present?		<input type="radio"/> 0	<input type="radio"/> 0.5	<input type="radio"/> 1	<input type="radio"/> 1.5	
2)	Are Amphibians Present?		<input type="radio"/> 0	<input type="radio"/> 0.5	<input type="radio"/> 1	<input type="radio"/> 1.5	
3)	Are AquaticTurtles Present?		<input type="radio"/> 0	<input type="radio"/> 0.5	<input type="radio"/> 1	<input type="radio"/> 1.5	
4)	Are Crayfish Present?		<input type="radio"/> 0	<input type="radio"/> 0.5	<input type="radio"/> 1	<input type="radio"/> 1.5	
5)	Are Macroinbenthos Present?		<input type="radio"/> 0	<input type="radio"/> 0.5	<input type="radio"/> 1	<input type="radio"/> 1.5	
6)	Are Iron Oxidizing Bacteria/Fungus Present?		<input type="radio"/> 0	<input type="radio"/> 0.5	<input type="radio"/> 1	<input type="radio"/> 1.5	
7)	Is Filamentous Algae Present?		<input type="radio"/> 0	<input type="radio"/> 0.5	<input type="radio"/> 1	<input type="radio"/> 1.5	
8)	Are Wetland Plants In Streambed?	SAV	Mostly OBL	Mostly FACW	Mostly FAC	Mostly FACU	Mostly UPL
(* NOTE: If Total Absence Of All Plants In Streambed As Noted Above Skip This Step UNLESS SAV Present*).		<input type="radio"/> 2	<input type="radio"/> 1	<input type="radio"/> 0.75	<input type="radio"/> 0.5	<input type="radio"/> 0	<input type="radio"/> 0

SECONDARY BIOLOGY INDICATOR POINTS:

#VALUE!

**TOTAL POINTS** (Primary + Secondary)=

#VALUE!

(If Greater Than Or Equal To 19 Points The Stream Is At Least Intermittent)

## Greensboro Stream Identification and Mapping for Water-Supply Watershed Protection

Additional Information for Intermittent and Perennial Stream Location Determination

Time:  Subbasin:  Stream ID:  Photo #s:

### Exposed Bedrock

☐ absent

**Distance from  
breakpoint (feet)**

No exposed bedrock

☐ weak

Exposed bedrock rare (e.g. one or two very small exposed areas.)

☐ moderate

Several areas with exposed bedrock, one or two areas may be large.

☐ strong

Exposed bedrock common.

### Weather Conditions

### Canopy Cover

☐ absent

No shading

☐ weak

Mostly full sun, few shaded areas

☐ moderate

Good shading with some breaks for light penetration

☐ strong

Canopy is full with very few breaks for light penetration

### Rainfall

### Channel Modification

☐ absent

No stormwater outfalls or channel modifications

☐ weak

One stormwater outfall or minor channel modification

☐ moderate

From 2 to 5 stormwater outfalls or some channel modifications

☐ strong

More than 5 stormwater outfalls or significant channel modifications

### Drainage Area Acreage

### Subbasin Percent Urbanized

### Water Color

☐ clear

☐ cloudy

☐ other

☐ N/A

### Water Odor

☐ Yes

☐ No

☐ N/A

### Conductivity (uS/cm)

# Biological Indicators

## Biological Information for Intermittent / Perennial Determination

<input type="checkbox"/>	Mayflies (Ephemeroptera)
<input type="checkbox"/>	Stoneflies (Plecoptera)
<input type="checkbox"/>	Caddisflies (Trichoptera)

### Secondary Perennial Indicators

<input type="checkbox"/>	Hellgrammites (Corydalidae)
<input type="checkbox"/>	Snails (Gastropoda)
<input type="checkbox"/>	Crayfish (Decapoda)
<input type="checkbox"/>	Leeches (Hirudinea)
<input type="checkbox"/>	Clams (Bivalvia)
<input type="checkbox"/>	Beetles (Coleoptera)
<input type="checkbox"/>	Two-lined salamander ( <i>Eurycea biline.</i> )

<input type="checkbox"/>	Dragonflies (Anisoptera)
<input type="checkbox"/>	Craneflies (nematocera)
<input type="checkbox"/>	Segmented Worms (Oligochaeta)
<input type="checkbox"/>	Damselflies (Zygoptera)
<input type="checkbox"/>	Midgeflies (Chironomidae)
<input type="checkbox"/>	Amphipods (Amphipoda)
<input type="checkbox"/>	Isopods (Isopoda)

### Primary Perennial Indicators

Ephemeroptera	Plecoptera	Trichoptera
<input type="checkbox"/> Baetidae	<input type="checkbox"/> Ectopectura spp.	<input type="checkbox"/> Hydropsychidae
<input type="checkbox"/> Stenonema spp.		<input type="checkbox"/> Psilotreta spp.
		<input type="checkbox"/> Neophylax spp.
		<input type="checkbox"/> Diplectrona spp.
		<input type="checkbox"/> Chimarra spp.

Biomass	
Abundant	> 10
Common	3 – 9
Rare	1 – 2

### Miscellaneous / Anecdotal Information

## Perennial Determination

# Field Work

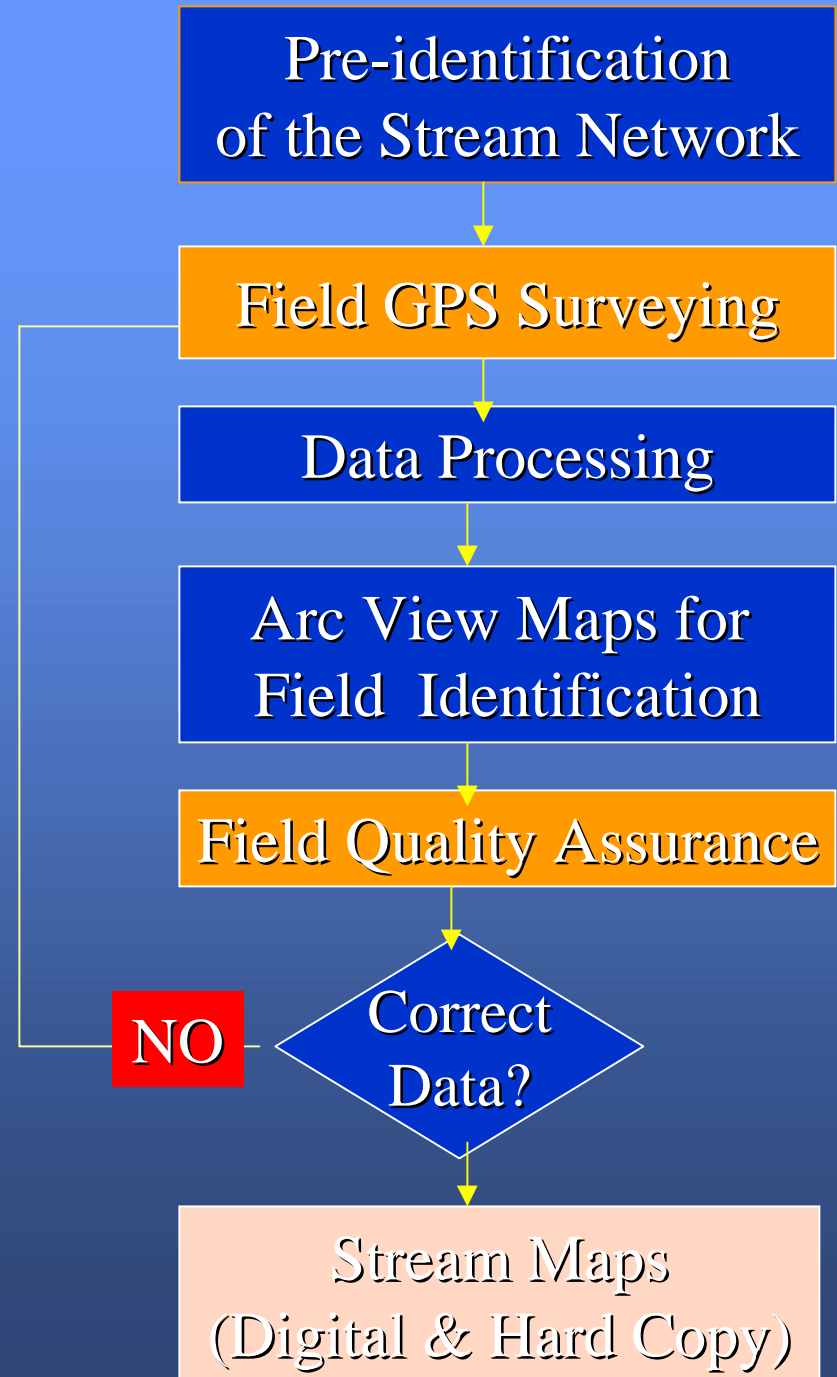
- Field teams may have to walk accross private property to access some streams
- Field personnel will attempt to contact property owners first
- Field teams will not drive onto private property without specific permission
- Field method is non-invasive

# What is a Global Positioning System (GPS)?

- The Global Positioning System (GPS) is a worldwide radio-navigation system formed from a constellation of 24 (NAVSTAR) satellites and their ground stations operated by the U.S. Department of Defense.
- The 24 operational NAVSTAR satellites orbiting the earth every 12 hours provide worldwide, all-weather, 24 hour time and position information.



# GIS Project Components





# Deliverables

- GIS Map
- Reports

# Project Benefits

- Benefits to the Public
  - Accurate Map
  - Water-Supply Protection
  - Wildlife Corridors/Aquatic Habitat
  - Green Space/Recreation
  - Educational Resource

# Project Benefits

- Developers/Business
  - Advance knowledge of undevelopable areas
  - Cost and Time Savings in Site Assessments
  - Available Electronically via Internet
  - Quick Reference Tool
  - Streamlines Regulatory Review.

# Project Benefits

- Regulators/State/Government
  - Method for identifying perennial vs. intermittent streams
  - Applications to other Piedmont watersheds
  - Applications (with modifications) to other NC watersheds and other states
  - Enhancement for Cape Fear River Basin
  - Data for Future Research
  - Stream Baseline Data

# Project Benefits

- City
  - Compliance with State Regulations (existing & anticipated)
  - Water Supply Protection